Los Alamos laser instrument arrives on Red Planet's surface

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LANL ChemCam to be tested soon and will begin probing Mars mysteries

LOS ALAMOS, New Mexico, August 6, 2012—Los Alamos National Laboratory scientists are elated by Sunday's successful landing of NASA's Curiosity rover on Mars, and are ready to begin a nearly two-year-long mission that will use a rock-zapping laser device mounted on the mast of the SUV-sized rover to help unravel mysteries of the Red Planet. The ChemCam laser characterization instrument was developed at LANL and the French space institute, IRAP.

"I can't describe the feeling when we realized that Curiosity had landed safely on the planet," said LANL planetary scientist Roger Wiens, principal investigator of the Mars Science Laboratory mission's ChemCam team. "My own curiosity about Mars began when I was a boy, and having an instrument that I've handled land on the Martian surface fulfills a lifelong dream that started long ago with a backyard telescope. This is an extremely happy, fulfilling moment."

The ChemCam system is one of 10 instruments mounted on the MSL mission's Curiosity rover—a six-wheeled mobile laboratory that will roam more than 12 miles of the planet's surface during the course of one Martian year (98 Earth weeks). When ChemCam fires its extremely powerful laser pulse, it briefly focuses the energy of a million light bulbs onto an area the size of a pinhead. The laser blast vaporizes part of its target up to seven meters (23 feet) away.

The resultant flash of glowing plasma is viewed by the system's 4.3-inch aperture telescope, which records the colors of light within the flash. These spectral colors are then interpreted by a spectrometer, enabling scientists to determine the elemental composition of the vaporized material. ChemCam also has a high-resolution camera that provides close-up images of an analyzed location. It can image a human hair from seven feet away.

The core ChemCam team is comprised of Los Alamos National Laboratory researchers and scientists from IRAP, a partner institution in Toulouse, France. Scientists from around the U.S., France, Canada, and the United Kingdom, along with post-doctoral researchers and students from LANL, round out the entire 45-person team.

Sometime around August 10 (sol 4 in Martian days after landing), the ChemCam team expects to take images of calibration targets mounted on the Rover. These initial tests

will help scientists determine the integrity of the ChemCam system and the pointing capability of the rover's mast, which supports ChemCam's laser and telescope.

The ChemCam instrument is the first to perform active remote sensing on the surface of the Red Planet. It can deliver three laser pulses each second to a single area, or it can quickly zap multiple areas, providing researchers with great versatility for sampling the surface of the planet. The first few laser pulses remove dust that would otherwise obscure the target surface, enabling scientists to observe the underlying sample. In that sense, the laser is like a long arm that can reach out more than twenty feet and brush off a sample before analysis.

The laser can profile through and study surface coatings on rocks, which, Earth scientists have learned, can often provide important clues to climate and water interaction, and can indicate biological interaction with surface materials. ChemCam is designed to look for lighter elements such as hydrogen, carbon, nitrogen, and oxygen, all of which are crucial for life, as well as to determine abundances of other elements.

After firing its laser, the ChemCam system looks at the entire visible spectrum as well as portions on either side (the infrared and ultraviolet), which gives the instrument the ability to see any element in the periodic table. Researchers expect to take the first analyses of the Martian surface sometime on or after sol 11 or 12 (August 17-18). The system is designed to capture as many as 14,000 observations throughout the mission.

Curiosity is expected to investigate the Gale Crater located close to the equator near the boundary between the southern highlands and the more featureless northern low plains of Mars. The massive crater spans 96 miles in diameter, an area roughly equivalent to the size of Connecticut and Rhode Island combined. A towering mountain, informally named Mount Sharp, rises up nearly three miles above the crater floor. This mammoth feature will provide opportunities for ChemCam to sample geologic layers on the mountainside.

"The amazing thing about the mountain in Gale crater is that it appears from orbit to be entirely sedimentary material," said Nina Lanza, a post-doctoral researcher in LANL's International, Space, and Response (ISR) division. "This is a collection of sedimentary layers that is nearly three times higher than the Grand Canyon is deep."

Probing this stratified geology with ChemCam could help researchers understand how the Red Planet transformed over time into a drier, less hospitable climate.

Los Alamos also has roles in other aspects of the Mars Science Laboratory. Dave Vaniman of LANL's Earth and Environmental Sciences Division is deputy leader of another instrument called CheMin, which uses X-ray diffraction to determine the composition of mineral samples collected and dropped into a funnel on the Curiosity rover.

Los Alamos also provided radioisotope fuel processing and encapsulation for the rover's electrical power generator and heat source, called a Multi-Mission Radioisotope Thermoelectric Generator (MMRTG). The generator keeps the rover's battery charged night and day, giving Curiosity the potential of being the longest-operating, farthest-traveling, most-productive Mars surface mission in history.

Weighing nearly a ton, Curiosity is the largest rover ever deployed to another planet. Previously, NASA sent a pair of much smaller rovers, Spirit and Opportunity, to Mars in January 2004. Both rovers gathered a wide range of rock and soil data that have helped provide important information about the wet environments on ancient Mars that may have been favorable to supporting microbial life. The Opportunity rover continues to

gather data and send images and information back to Earth—surpassing its planned mission by many years.

For more information about ChemCam, please visit its website: http://www.msl-chemcam.com